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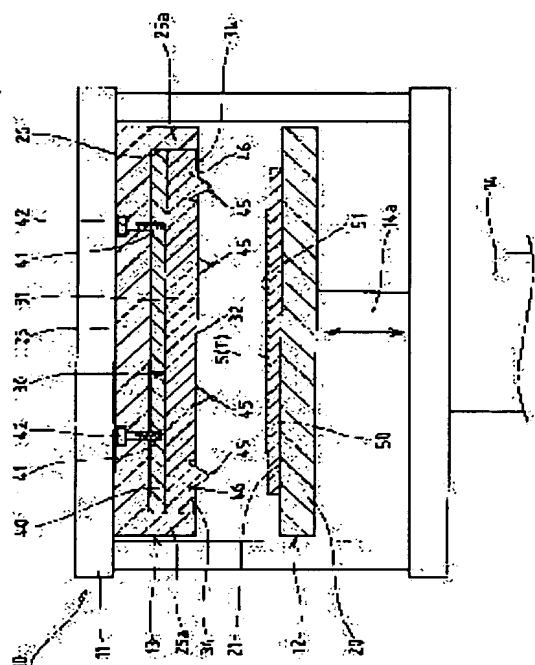
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## (54) PRESSURE FORMING DEVICE

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To prevent the deterioration of production efficiency and the deterioration of forming quality of a laminated body by making a tray member and the laminated body surely separable from an elastic pressurizing member after completing the pressurization of the laminated body.

**SOLUTION:** Elastic projecting parts 45 are provided on the abutting face 32 of the elastic pressurizing member 30 furnished on a second pressurizing member 13 in a manner that the elastic projecting parts 45 are usually projected from the abutting face 32 by a desired amount and is elastically deformed by the pressurizing force to the level of the abutting face 32 when a mounting face 51 of the tray member 50 supported by a first pressurizing member 12 is abutted. The tray member 50 and the laminated body T are separated from the abutting face 32 of the elastic pressurizing member 30 under the elastic recovering action of the elastic projection parts 45 when the first pressurizing member 12 and the second pressurizing member 13 are separated after completing the pressurization of the laminated body T. Recessed parts 46 are formed around the periphery of the elastic projecting parts 45 on the abutting face 32 of the elastic pressurizing member 30 and the elastic projecting parts 45 pressurized by the tray member 50 are elastically deformed into the recessed parts 46.



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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The 1st pressurization member which can be held for the tray member (50) for laying the pressing-ed goods (S) to which the laminating of the web material was carried out, enabling free attachment and detachment (12), It consists of the 2nd pressurization member (13) which prepared the elastic press member (30) equipped with the contact side (32) to which it points in this 1st pressurization member (12). These 1st pressurization member (12) and the 2nd pressurization member (13) are made to approach compulsorily. By pressurizing said pressing-ed goods (S) at homogeneity according to the installation side (51) of said tray member (50), and the contact side (32) of said elastic press member (30) In the pressing equipment which manufactures the layered product (T) which said each web material stuck mutually In the contact side (32) of said elastic press member (30), only requirements from an applicable plane of composition (32) in a usual state A projection, When the installation side (51) of said tray member (50) contacts, the elastic projected part (45) which carries out elastic deformation to the level of said contact side (32) by the thrust is prepared. When the pressurization of said layered product (T) is completed and said 1st pressurization member (12) and the 2nd pressurization member (13) are made to estrange Pressing equipment characterized by constituting so that said tray member (50) and layered product (T) may be made to separate into the bottom of an elastic return operation of said elastic projected part (45) from the contact side (32) of said elastic press member (30).

[Claim 2] This elastic projected part (45) that the crevice (46 / 49a, 49b) facing the perimeter of said elastic projected part (45) was formed by the contact side (32) of said elastic press member (30), and was pressed by said tray member (50) is pressing equipment according to claim 1 which carries out elastic deformation to said crevice (46 / 49a, 49b).

[Claim 3] In said elastic projected part (45), the volume for the lobe projected outside from the contact side (32) of said elastic press member (30) (45a) It is set up identically to the volume of said crevice (46 / 49a, 49b) cut from the applicable plane of composition (32) inside thru/or a little small. Pressing equipment according to claim 2 with which said elastic projected part (45) which carried out elastic deformation is completely held into said crevice (46 / 49a, 49b) in case said tray member (50) sticks to said contact side (32) extensively.

[Claim 4] Said elastic projected part (45) is pressing equipment given in any of claims 1-3 currently formed in said elastic press member (30) in one they are.

[Claim 5] For said elastic press member (30), said elastic projected part (45) is pressing equipment given in any of claims 1-3 they are by which installation immobilization is carried out at the installation section (33) which it was formed in another object and prepared in this elastic press member (30).

[Claim 6] Said elastic projected part (45) is pressing equipment according to claim 5 installed removable to said elastic press member (30) using a proper holddown member (44).

[Claim 7] Said elastic projected part (45) is pressing equipment according to claim 5 installed by this elastic press member (30) removable in the bottom of mutual engagement in the 2nd engagement section (56) prepared in said 1st engagement section [ which was prepared in this elastic projected part (45) in one ] (55), and elastic press member (30) side.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] About pressing equipment, further, this invention is pressurizing at homogeneity the pressing-ed goods laid in this tray member by the elastic press member prepared in the tray member and the 2nd pressurization member which were held to the 1st pressurization member at the detail, and relates to amelioration of the pressing equipment which fabricates the layered product which the web material stuck mutually.

[0002]

[Description of the Prior Art] For example, as a ceramic layered product, while the laminating ceramic substrate, the laminating ceramic capacitor, etc. are known, operation is presented widely. Among these, a laminating ceramic substrate presents the structure in which the circuit pattern was formed between the thin layer of two or more ceramics, and this thin layer, and the laminating ceramic capacitor is presenting the structure which carried out the laminating of the thin layer of the ceramics, and the thin film-like internal electrode by turns. Such a ceramic layered product is fabricated by the condition that each web material stuck mutually, by pressurizing with the pressing equipment which used the mold for pressing of the indication of the pressing-ed goods which carried out the laminating of two or more ceramic green sheets which carried out printing formation of a circuit pattern or the internal electrode to the whole surface to JP,2000-79611,A.

[0003] The 1st pressurization member by which pressing-ed goods are laid in a center section [ in / in the mold for pressing of an indication in said official report / a top face ] (female mold), By the basis which consisted of 2nd pressurization members (punch) equipped with the massive elastic member (henceforth an "elastic press member") which has flexibility, and laid the pressurized molding article in the top face of said 1st pressurization member By making this 1st pressurization member approach said 2nd pressurization member compulsorily, this pressurized molding article is pressurized at homogeneity. That is, a pressurized molding article is pressurized from the upper and lower sides in respect of contact of the installation side of the 1st pressurization member, and said elastic press member, and each ceramic green sheet sticks it mutually by this, and it fabricates a ceramic layered product. Here, in said pressing-ed goods which come to carry out the laminating of these two or more sheets, since the circuit pattern and the internal electrode are formed in said ceramic green sheet as mentioned above, while thickness differs partially, delicate irregularity is formed in the front face. For this reason, with said mold for pressing, while raising the smoothness of the installation side of the 1st pressurization member, at the time of pressing, this elastic press member is enabling homogeneity-pressurization by carrying out flattery deformation at the shape of surface type of pressing-ed goods by equipping the 2nd pressurization member with the elastic press member which has flexibility. In addition, the ceramic layered product of high quality can be fabricated, so that whenever [ to said pressing-ed goods / stoving temperature ] and welding pressure (compression force) are heightened.

[0004]

[Problem(s) to be Solved by the Invention] By the way, with the production line of said ceramic layered product, said pressing-ed goods and the fabricated ceramic layered product are transported in the condition of having laid in the tray member which moves along this Rhine. Therefore, when presenting operation with the pressing equipment which equipped said official report with the mold for pressing of an indication with the production line of a ceramic layered product, the gestalt which holds the tray member which laid said pressing-ed goods free [ attachment and detachment ] on the top face of said 1st pressurization member is taken. For this reason, in fact, the smoothness of the installation side of said tray member is raised, and when said 1st pressurization

member and the 2nd pressurization member are made to approach compulsorily, said pressing-ed goods will be pressurized at homogeneity in respect of contact of the installation side of this tray member, and said elastic press member. Even if it is in such a shaping gestalt, shaping of a good ceramic layered product is possible by raising the smoothness of the installation side of said tray member.

[0005] However, when the tray member mentioned above was used, the new problem like a degree had occurred. That is, since the installation side of said tray member is set up at least more greatly than said pressing-ed goods, the part of the installation side which does not touch these pressing-ed goods contacts the contact side of said elastic press member directly, and it comes to stick it. However, since the welding pressure of dozens of t is given to hundreds of degrees C while heating incubation is carried out in order to heat pressing-ed goods as said mold for pressing was mentioned above Having un-arranged [ for which the ceramic layered product and tray member which were fabricated are having stuck to the contact side of an elastic press member with as ], even if the adhesion force increases considerably and the elastic press member and tray member which were stuck made the 1st pressurization member estrange from the 2nd pressurization member after pressurization termination. And this adhesion phenomenon had appeared so notably that it appears so notably that welding pressure becomes high while appearing so notably that whenever [ stoving temperature ] becomes high, and it is going to fabricate a good layered product if it puts in another way. For this reason, when it becomes [ being stuck to a ceramic layered product and a tray member with as, and ] the 2nd pressurization member (elastic press member), the whole production line will be temporarily made a halt, the removal activity of the tray member concerned and a layered product will be done, and the problem which invites production degradation arises. When whenever [ stoving temperature ], and welding pressure are set up lowness on the other hand in order to avoid such un-arranging, the problem to which the incidence rate of a defective becomes high by poor shaping, layer exfoliation, etc. by poor sticking by pressure of each web material will arise.

[0006]

[Objects of the Invention] This invention to the contact side of the elastic press member which was proposed in order to solve suitably the technical problem mentioned above, and contacts a tray member directly With constituting so that the elastic projected part in which elastic deformation is possible may be prepared by contact of this tray member and a tray member and a layered product may be made to separate into the bottom of an elastic return operation of said elastic projected part from an elastic press member after pressurization termination It aims at offering the pressing equipment which prevents the production degradation of a layered product, the nature fall of mold goods, etc.

[0007]

[Means for Solving the Problem] In order to solve said technical problem and to attain the desired end this invention The 1st pressurization member which can be held for the tray member for laying the pressing-ed goods to which the laminating of the web material was carried out, enabling free attachment and detachment, It consists of the 2nd pressurization member which prepared the elastic press member equipped with the contact side to which it points in this 1st pressurization member. Make these 1st pressurization member and the 2nd pressurization member approach compulsorily, and said pressing-ed goods by pressurizing homogeneity according to the installation side of said tray member, and the contact side of said elastic press member In the pressing equipment which manufactures the layered product which said each web material stuck mutually In the contact side of said elastic press member, only requirements from an applicable plane of composition in a usual state A projection, When the installation side of said tray member contacts, the elastic projected part which carries out elastic deformation to the level of said contact side by the thrust is prepared. When the pressurization of said layered product is completed and said 1st pressurization member and the 2nd pressurization member are made to estrange, it is characterized by constituting so that said tray member and layered product may be made to separate into the bottom of an elastic return operation of said elastic projected part from the contact side of said elastic press member.

[0008]

[Embodiment of the Invention] Next, about the pressing equipment concerning this invention, a suitable example is given, and it explains below, referring to an accompanying drawing.

[0009]

[The 1st example] Drawing 5 is the outline block diagram showing a part of pressing equipment concerning the 1st example of this invention in the condition of having fractured. The pressing equipment 10 of this 1st example the frame 11 of the shape of a rectangle frame fixed to the necessary location of the production line which is not illustrated — receiving — rise and fall — it consists of female mold 12 as the 1st pressurization member

arranged movable, and a punch 13 as the 2nd pressurization member fixed to the inside upper part of said frame 11.

[0010] Said female mold 12 makes a subject the body 20 of female mold of the shape of a flat-surface rectangle fixed at the tip of rod 14a of the hydrostatic pressure cylinder (for example, oil hydraulic cylinder) 14 installed in said frame 11 bottom. (Female mold) If said hydrostatic pressure cylinder 14 is controlled so that rod 14a moves forward, it will go up in the state of a horizontal position, and contiguity migration will be carried out to said punch 13, and if this hydrostatic pressure cylinder 14 is controlled so that rod 14a retreats, it will descend in the state of a horizontal position, and will estrange from said punch 13. And while the installation section 21 which can hold the rectangle tabular tray member 50 which moves along with a production line free [ attachment and detachment ] in the level condition is formed in the top face of the body 20 of female mold, a heating means (not shown) to heat the pressing-ed goods S laid in said tray member 50 to predetermined temperature is laid under the interior of this body 20 of female mold. In addition, as a heating means, a heating-wire heater, the heat pipe with which a heat carrier circulates, a heat plate, etc. are adopted suitably. Moreover, it is automatically detached [ the tray member 50 / when said female mold 12 has stopped in the lowest location ] and attached to the installation section 21 by the autoloader equipment which is not illustrated.

[0011] (Tray member) As said tray member 50 is shown in drawing 1 and drawing 5, from said pressing-ed goods S, suitably, it is the plate-like part material set up greatly, and the installation side 51 for laying these pressing-ed goods S is formed in high smoothness. When the smoothness of said installation side 51 is illustrated concretely, if the "flatness" measured based on JISB0601 is possible, its 0.01mm or less is desirable at least 0.04mm or less. Moreover, at least 0.4 "micrometers of surface roughness" or less is preferably set to 0.1 micrometers.

[0012] (Punch) It is fixed to the crevice 26 for wearing formed by this punch body [ which is fixed to the inside upper part in said frame 11 using the bolt which is not illustrated ] 25, and punch body 25 bottom, and said punch 13 consists of elastic press members 30 with which it was equipped so that it might point to the installation section 21 of said female mold 12. Said elastic press member 30 is firmly fixed to the buttress plate 40 which makes nonferrous metals, such as steel or aluminum, the quality of the material by said crevice 26 for wearing by carrying out vulcanization adhesion extensively using heat-resistant adhesives etc., \*\*\*\*ing the mounting bolt 42 inserted in from the upper part of said punch body 25, and stuffing a hole 41. In addition, in said elastic press member 30 fixed to the punch body 25, it is set up so that it may counter horizontally [ the contact side 32 which pointed to the lower part, and the installation side 51 of the tray member 50 by which set maintenance is carried out at the installation section 21 of said female mold 12 ], and in parallel.

[0013] (Elastic press member) And said elastic press member 30 in the pressing equipment 10 of the 1st example makes the subject the tabular body 31 fabricated by necessary thickness in the shape of a flat-surface abbreviation rectangle from the flexible spring material which has elasticity, as shown in drawing 1 and drawing 2. This body 31 is set as the size which it is set up suitably more greatly than the flat-surface size of said tray member 50, and is stuck to the inner skin of frame-like perpendicular wall 25a in said punch body 25. Moreover, when hold immobilization is carried out, thickness h of a body 31 is set as said crevice 26 for wearing so that it may become the height and abbreviation identitas of said frame-like perpendicular wall 25a including the thickness of said buttress plate 40. As durable conditions for the elastic press member 30, as for these maximum pressure resistance and the maximum heatproof temperature, 1,200kg/cm<sup>2</sup> or more and the maximum heatproof temperature are not required of coincidence for it here, although the maximum pressure resistance is made into 300 degrees C or more.

[0014] (Elastic projected part) And in the elastic press member 30 of the 1st example, the conic elastic projected part [ two or more (an example eight pieces) ] 45 in which only requirements project below from the applicable plane of composition 32 is formed [ the usual state ] in said contact side 32 formed in the inferior surface of tongue of said body 31 in one at this body 31. As shown in drawing 1, when it is prepared in the location which does not interfere in said pressing-ed goods S which are the locations which contact said tray member 50, and were laid in this tray member 50 and said installation side 51 of the tray member 50 contacts, elastic deformation of each [ these ] elastic projected part 45 is carried out to the level of said contact side 32 by the thrust ( drawing 3 ). And if elastic deformation of each elastic projected part 45 is carried out by contact of the tray member 50, the return elasticity which is going to carry out a configuration return to the original protrusion condition will occur, and it will act so that this may make this tray member 50 separate from the elastic press member 30. Therefore, with the pressing equipment 10 of the 1st example, when female mold 12 is made to estrange from said punch 13 after pressurization termination of a layered product T, it may have comes

to separate said tray member 50 and layered product T into the bottom of an elastic return operation of each elastic projected part 45 from the contact side 32 of said elastic press member 30.

[0015] Moreover, when the annular concave slot (crevice) 46 facing the perimeter said each elastic projected part 45 of every is formed and said tray member 50 contacts the elastic projected part 45, elastic deformation is carried out to the contact side 32 of the body 31 in said elastic press member 30 to the concave slot 46 where this elastic projected part 45 adjoins. And in said elastic projected part 45, it is set up identically to the volume of said concave [ which was projected outside from the contact side 32 of said body 31 ] slot 46 in which the volume of partial 45a was cut from the applicable plane of composition 32 by projecting inside thru/or a little small. Therefore, when the tray member 50 comes to stick to the contact side 32 of the elastic press member 30 extensively, said elastic projected part 45 which carried out elastic deformation is completely held into said concave slot 46, and it is set up so that it may not project at all from the contact side 32. Moreover, the air guide rail 34 the edge section of each concave slot 46 and the edge section of a body 31 are connected [ air ] is formed in said contact side 32, the tray member 50 sticks to this body 31, the elastic projected part 45 can face holding to said concave slot 46, and \*\*\*\* guidance of the air which remains in this concave slot 46 can be carried out now to the exterior.

[0016] In addition, the material with which said elastic press member 30 has proper elasticity, such as special synthetic rubber, such as natural rubber, diene rubber, olefin rubber, acrylic nitril butadiene rubber, silicone rubber, a fluororubber, chlorosulfonated polyethylene, chlorinated polyethylene, chlorinated butyl rubber, polysulfide rubber, polyurethane rubber, acrylic rubber, epichlorohydrin rubber, polypropylene oxide, and an ethylene vinyl acetate polymer, and thermoplastic elastomer, may be adopted.

[0017]

[An operation of the 1st example] The elastic press member 30 which comes in one to fabricate the elastic projected part 45 with the pressing equipment 10 of the 1st example constituted as mentioned above to the contact side 32 of a body 31 is fixed to said buttress plate 40 by the basis which carried out vulcanization adhesion extensively in the crevice 26 for wearing of the punch body 25 in a punch 13 using a mounting bolt 42 using heat-resistant adhesives etc. Thereby, the condition of having pointed to the installation section 21 in said female mold 12 is equipped with the elastic press member 30.

[0018] And said tray member 50 which set to the installation side 51 the pressing-ed goods S which come to carry out the laminating of the ceramic green sheet by the basis installed in the production line By controlling said hydrostatic pressure cylinder 14 so that rod 14a moves forward if the pressing-ed goods S are heated by predetermined temperature with said heating means of this female mold 12 after being held with the autoloader equipment which is not illustrated at the installation section 21 of female mold 12 The female mold 12 holding the tray member 50 goes up, and contiguity migration is carried out to said punch 13. At this time, the tray member 50 by which set maintenance was carried out at the installation section 21 of female mold 12 contacts at the tip of each elastic projected part 45 first, and thereby, with the updrift of this female mold 12, each elastic projected part 45 is pressed gradually, and it comes to carry out elastic deformation.

[0019] Furthermore, if said female mold 12 carries out updrift, the pressing-ed goods S will stick first in contact with the contact side 32 of said elastic press member 30, and the installation side 51 of the tray member 50 will come to stick in contact with the applicable plane of composition 32 behind suitably. Said each elastic projected part 45 which deformed at this time comes to constitute a part of applicable plane of composition 32 while it comes to be held completely and does not project at all from said contact side 32 into said concave slot 46, and as shown in drawing 3 , it comes to stick it to the installation side 51 of the tray member 50 with said contact side 32.

[0020] And when said female mold 12 arrives at the best location and updrift is completed, predetermined welding pressure is given to female mold 12 and a punch 13 by the energization force of said hydrostatic pressure cylinder 14, and said pressing-ed goods S are pressurized by the contact side 32 of the elastic press member 30, and the installation side 51 of the tray member 50 from the upper and lower sides. \*\*\*\*\* the pressing-ed goods S have the difference in thickness partially or irregularity is shown in a front face at this time — the installation side 51 of said tray member 50 — quantity, while being formed flat and smooth Since elastic deformation is carried out so that the contact side 32 of said elastic press member 30 may follow in the shape of [ of the pressing-ed goods S ] surface type The ceramic layered product T by which each ceramic green sheet stuck the pressing-ed goods S mutually when the vertical both sides were pressurized by homogeneity and set up whenever [ stoving temperature ], and welding pressure appropriately comes to be fabricated suitably.

[0021] controlling said hydrostatic pressure cylinder 14 so that rod 14a retreats if shaping of the ceramic layered product T is completed by pressurizing the pressing-ed goods S — female mold 12 — downward initiation — carrying out — from a punch 13 — gradually — alienation — it comes to move and the pressurization to the tray member 50 and the fabricated ceramic layered product T is canceled gradually. Since it acts at this time so that the return elasticity of each elastic projected part 45 may press said tray member 50 below, this tray member 50 is separated into the bottom of an elastic return operation of this elastic projected part 45 from the elastic press member 30. in addition, the return elasticity of each elastic projected part 45 — the tray member 50 — acting (since each elastic projected part 45 not touching the ceramic layered product T) — since the adhesion force of this layered product T and the tray member 50 is stronger than the adhesion force of this layered product T and the elastic press member 30, this ceramic layered product T is separated from the contact side 32 of the elastic press member 30, stuck to the tray member 50.

[0022] Thus, when the energization to female mold 12 and a punch 13 is canceled after shaping of the ceramic layered product T, the tray member 50 and the ceramic layered product T can be made to separate into the bottom of an elastic return operation of each elastic projected part 45 prepared in the elastic press member 30 from this elastic press member 30 certainly with the pressing equipment 10 concerning the 1st example. Being held by this, while the tray member 50 and the ceramic layered product T had stuck to the elastic press member 30 after shaping is avoided suitably, and it does not invite the production degradation by halt of the whole production line. Moreover, even if it raises whenever [ by said heating means / stoving temperature ] or fabricates by the basis which raised welding pressure, the tray member 50 and the ceramic layered product T can be made to separate from the elastic press member 30 certainly after shaping, poor sticking by pressure and poor shaping of each web material, layer exfoliation, etc. are avoided suitably, and upgrading of a ceramic layered product can be planned.

[0023] Moreover, by establishing the concave slot 46 in the perimeter of the elastic projected part 45, the elastic projected part 45 which deformed by press of the tray member 50 deforms so that it may hold in this concave slot 46, and the return elasticity beyond the need is not given at the time of shaping. And if the volume of lobe part 45a of the elastic projected part 45 projected from the contact side 32 is set up identically to the volume of said concave slot 46 thru/or a little small, in case the tray member 50 will stick it to the contact side 32 of the elastic press member 30 extensively, the elastic projected part 45 which deformed is completely held into said concave slot 46, and does not check adhesion of both the members 30 and 50.

[0024]

[The 2nd example] Drawing 6 is the sectional side elevation showing the elastic press member carried out by the pressing equipment concerning the 2nd example of this invention. In addition, since, as for the pressing equipment of the 2nd example, only the gestalten of the elastic press member 30 only differ as compared with said 1st example, it illustrates only about this elastic press member, a sign with same members other than this is attached, and explanation is omitted.

[0025] The elastic press member 30 of the 2nd example forms a body 31 and each elastic projected part 45 in an exception object, respectively, as shown in drawing 6 . That is, two or more (an example eight pieces) installation holes (installation section) 33 of the shape of a circular through-hole on condition of the configuration and size of the elastic projected part 45 by which another object shaping was carried out in the location which does not interfere in said pressing-ed goods S which are the locations which contact said tray member 50, and were laid in this tray member 50 are established by the body 31. Moreover, the bolt insertion hole 43 corresponding to each installation hole 33 is established by said buttress plate 40. In addition, the configuration, the size, and the quality of the material of a body 31 are the same as that of the elastic press member 30 of the 1st example.

[0026] On the other hand, said each elastic projected part 45 is fabricated by the edge of the supporter 47 of the circle configuration by which fitting is carried out to said installation hole 33 in one through the narrow diameter portion 48. And by fixing to a buttress plate 40 said supporter 47 which fitted into the installation hole 33 of correspondence with the securing bolt (holddown member) 44 inserted in the bolt insertion hole 43, said elastic projected part 45 is set up so that it may project suitably from the contact side 32. Therefore, since the return elasticity which is going to carry out elastic deformation to the same height as said contact side 32 by the thrust, and is going to carry out a configuration return to the original protrusion condition by this occurs when said installation side 51 of said tray member 50 contacts, it comes to energize the tray member 50.

[0027] Moreover, while proper concave slot 49a is formed around the elastic projected part 45, when another space section 49b is formed by the perimeter of said narrow diameter portion 48 and the installation side 51 of



said tray member 50 and the contact side 32 of said elastic press member 30 stick to it mutually, elastic deformation is carried out so that this elastic projected part 45 may fill said concave slot 49a and space section 49b ( drawing 7 ). And in said elastic projected part 45, it projects and the volume of partial 45a is set up identically to the volume which was projected outside from the contact side 32 of said body 31 and which totaled said concave slot 49a and space section 49b thru/or a little small. Therefore, when the tray member 50 contacts, into said crevice 49a and space section 49b, said elastic projected part 45 which carried out elastic deformation is held completely, and does not project at all from the contact side 32.

[0028] When the energization to female mold 12 and a punch 13 is canceled after shaping of the ceramic layered product T, the tray member 50 and the ceramic layered product T can be made to separate into the bottom of an elastic return operation of each elastic projected part 45 installed in the elastic press member 30 from this elastic press member 30 certainly with the pressing equipment 10 concerning the 2nd example which carried out such an elastic press member 30. Thereby, it is avoided suitably that the tray member 50 and the ceramic layered product T will stick to the elastic press member 30, and will be held after shaping, and it does not invite the production degradation by halt of the whole production line. Moreover, even if it raises whenever [ by said heating means / stoving temperature ] or fabricates by the basis which raised welding pressure, the tray member 50 and the ceramic layered product T can be made to separate from the elastic press member 30 certainly after shaping, poor sticking by pressure and poor shaping of each web material, layer exfoliation, etc. are avoided suitably, and upgrading of a ceramic layered product can be planned.

[0029] In addition, since another object shaping is carried out with a body 31, said elastic projected part 45 can also be considered as different material as well as considering as the same quality of the material as this body 31. For example, since the return elasticity at the time of elastic deformation becomes large when it forms from a hard spring material from a body 31, when the thrust to the tray member 50 increases and it forms from an elastic spring material from said body 31, since the return elasticity at the time of elastic deformation becomes small, the thrust to the tray member 50 decreases. Moreover, it is also possible to install the elastic projected part 45 from which the quality of the material differs every installation hole 33.

[0030] Moreover, only in this elastic projected part 45, when it continued at the long period of time, and operation was presented, and said each elastic projected part 45 deteriorates or it is damaged, since it is exchangeable, reduction of a running cost is attained with a new article.

[0031]

[The example of modification of the 2nd example] Drawing 9 is the important section sectional view of the elastic press member 30 concerning the modification of the 2nd example shown in drawing 6 . In this example of modification, the elastic projected part 45 by the basis on condition of forming in a body 31 and another object It is made to carry out installation immobilization of the elastic projected part 45 concerned at the installation hole 33 by making the engagement protruding piece 55 as the 1st engagement section formed in the edge of said supporter 47 of this elastic projected part 45 in one engage with the engagement hole 56 as the 2nd engagement section formed in said buttress plate 40. Also in the elastic press member 30 of this example of modification, when it continued at the long period of time, and operation was presented, and said each elastic projected part 45 deteriorates or it is damaged, since it is as exchangeable as a new article only in this elastic projected part 45, reduction of a running cost is possible.

[0032] In addition, although the elastic press member 30 which consists only of an elastic projected part 45 which showed the elastic press member 30 which consists only of an elastic projected part 45 fabricated in one to the body 31, and was fabricated in the 2nd example on the body 31 and another object was illustrated in the 1st example, it is good also as an elastic press member which formed in mixture both elastic projected parts 45 formed in the body 31, the elastic projected part 45 formed in one, and another object. Moreover, although the elastic press member 30 constituted only from an elastic projected part 45 of the same size, respectively was illustrated in said each example, you may make it form the elastic projected part 45 of different size for every location.

[0033] Moreover, although the elastic projected part 45 made into the configuration of reverse 3 corniform was illustrated in said each example, the configuration of this elastic projected part 45 is not limited to this, and it can be set as various configurations on the assumption that suitable return elasticity is given to the tray member 50 after shaping.

[0034]

[Effect of the Invention] When according to the pressing equipment concerning this invention the pressurization of a layered product is completed and the 1st pressurization member and the 2nd pressurization member are

made to estrange as explained above, a tray member and a layered product may be certainly separated into the bottom of an elastic return operation of each elastic projected part prepared in the elastic press member from the contact side of this elastic press member. Un-arranging [ which is held by this while the tray member and this layered product had stuck to the elastic press member after shaping of a layered product ] is avoided suitably, and the useful effectiveness which does not invite the production degradation by halt of the whole production line is done so. Moreover, even if it raises whenever [ stoving temperature / of pressing-ed goods ] or performs pressing by the basis which raised the welding pressure to these pressing goods, a tray member and a layered product can be made to separate from an elastic press member certainly after shaping, and there is also an advantage which can plan upgrading of a layered product. Moreover, by establishing the crevice in the perimeter of an elastic projected part, the elastic projected part which deformed by press of a tray member deforms so that it may hold in this crevice, and unnecessary return elasticity is not given at the time of shaping. And if the volume for a lobe of the elastic projected part projected from the contact side is set up identically to the volume of said crevice thru/or a little small, in case a tray member will stick it to the contact side of an elastic press member extensively, the elastic projected part which deformed is completely held into said crevice, and does not check adhesion of both members. In addition, you may fabricate in one and an elastic press member and an elastic projected part can also fabricate each on another object. If an elastic projected part is demounted and it is made to equip possible while becoming possible to constitute each from a material of the different quality of the material, when both are considered as another object shaping here, it will become exchangeable [ this elastic projected part ].

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[Translation done.]

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TECHNICAL FIELD

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[Field of the Invention] About pressing equipment, further, this invention is pressurizing at homogeneity the pressing-ed goods laid in this tray member by the elastic press member prepared in the tray member and the 2nd pressurization member which were held to the 1st pressurization member at the detail, and relates to amelioration of the pressing equipment which fabricates the layered product which the web material stuck mutually.

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PRIOR ART

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[Description of the Prior Art] For example, as a ceramic layered product, while the laminating ceramic substrate, the laminating ceramic capacitor, etc. are known, operation is presented widely. Among these, a laminating ceramic substrate presents the structure in which the circuit pattern was formed between the thin layer of two or more ceramics, and this thin layer, and the laminating ceramic capacitor is presenting the structure which carried out the laminating of the thin layer of the ceramics, and the thin film-like internal electrode by turns. Such a ceramic layered product is fabricated by the condition that each web material stuck mutually, by pressurizing with the pressing equipment which used the mold for pressing of the indication of the pressing-ed goods which carried out the laminating of two or more ceramic green sheets which carried out printing formation of a circuit pattern or the internal electrode to the whole surface to JP,2000-79611,A.

[0003] The 1st pressurization member by which pressing-ed goods are laid in a center section [ in / in the mold for pressing of an indication in said official report / a top face ] (female mold), By the basis which consisted of 2nd pressurization members (punch) equipped with the massive elastic member (henceforth an "elastic press member") which has flexibility, and laid the pressurized molding article in the top face of said 1st pressurization member By making this 1st pressurization member approach said 2nd pressurization member compulsorily, this pressurized molding article is pressurized at homogeneity. That is, a pressurized molding article is pressurized from the upper and lower sides in respect of contact of the installation side of the 1st pressurization member, and said elastic press member, and each ceramic green sheet sticks it mutually by this, and it fabricates a ceramic layered product. Here, in said pressing-ed goods which come to carry out the laminating of these two or more sheets, since the circuit pattern and the internal electrode are formed in said ceramic green sheet as mentioned above, while thickness differs partially, delicate irregularity is formed in the front face. For this reason, with said mold for pressing, while raising the smoothness of the installation side of the 1st pressurization member, at the time of pressing, this elastic press member is enabling homogeneity-pressurization by carrying out flattery deformation at the shape of surface type of pressing-ed goods by equipping the 2nd pressurization member with the elastic press member which has flexibility. In addition, the ceramic layered product of high quality can be fabricated, so that whenever [ to said pressing-ed goods / stoving temperature ] and welding pressure (compression force) are heightened.

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EFFECT OF THE INVENTION

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[Effect of the Invention] When according to the pressing equipment concerning this invention the pressurization of a layered product is completed and the 1st pressurization member and the 2nd pressurization member are made to estrange as explained above, a tray member and a layered product may be certainly separated into the bottom of an elastic return operation of each elastic projected part prepared in the elastic press member from the contact side of this elastic press member. Un-arranging [ which is held by this while the tray member and this layered product had stuck to the elastic press member after shaping of a layered product ] is avoided suitably, and the useful effectiveness which does not invite the production degradation by halt of the whole production line is done so. Moreover, even if it raises whenever [ stoving temperature / of pressing-ed goods ] or performs pressing by the basis which raised the welding pressure to these pressing goods, a tray member and a layered product can be made to separate from an elastic press member certainly after shaping, and there is also an advantage which can plan upgrading of a layered product. Moreover, by establishing the crevice in the perimeter of an elastic projected part, the elastic projected part which deformed by press of a tray member deforms so that it may hold in this crevice, and unnecessary return elasticity is not given at the time of shaping. And if the volume for a lobe of the elastic projected part projected from the contact side is set up identically to the volume of said crevice thru/or a little small, in case a tray member will stick it to the contact side of an elastic press member extensively, the elastic projected part which deformed is completely held into said crevice, and does not check adhesion of both members. In addition, you may fabricate in one and an elastic press member and an elastic projected part can also fabricate each on another object. If an elastic projected part is demounted and it is made to equip possible while becoming possible to constitute each from a material of the different quality of the material, when both are considered as another object shaping here, it will become exchangeable [ this elastic projected part ].

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] By the way, with the production line of said ceramic layered product, said pressing-ed goods and the fabricated ceramic layered product are transported in the condition of having laid in the tray member which moves along this Rhine. Therefore, when presenting operation with the pressing equipment which equipped said official report with the mold for pressing of an indication with the production line of a ceramic layered product, the gestalt which holds the tray member which laid said pressing-ed goods free [ attachment and detachment ] on the top face of said 1st pressurization member is taken. For this reason, in fact, the smoothness of the installation side of said tray member is raised, and when said 1st pressurization member and the 2nd pressurization member are made to approach compulsorily, said pressing-ed goods will be pressurized at homogeneity in respect of contact of the installation side of this tray member, and said elastic press member. Even if it is in such a shaping gestalt, shaping of a good ceramic layered product is possible by raising the smoothness of the installation side of said tray member.

[0005] However, when the tray member mentioned above was used, the new problem like a degree had occurred. That is, since the installation side of said tray member is set up at least more greatly than said pressing-ed goods, the part of the installation side which does not touch these pressing-ed goods contacts the contact side of said elastic press member directly, and it comes to stick it. However, since the welding pressure of dozens of t is given to hundreds of degrees C while heating incubation is carried out in order to heat pressing-ed goods as said mold for pressing was mentioned above Having un-arranged [ for which the ceramic layered product and tray member which were fabricated are having stuck to the contact side of an elastic press member with as ], even if the adhesion force increases considerably and the elastic press member and tray member, which were stuck made the 1st pressurization member estrange from the 2nd pressurization member after pressurization termination. And this adhesion phenomenon had appeared so notably that it appears so notably that welding pressure becomes high while appearing so notably that whenever [ stoving temperature ] becomes high, and it is going to fabricate a good layered product if it puts in another way. For this reason, when it becomes [ being stuck to a ceramic layered product and a tray member with as, and ] the 2nd pressurization member (elastic press member), the whole production line will be temporarily made a halt, the removal activity of the tray member concerned and a layered product will be done, and the problem which invites production degradation arises. When whenever [ stoving temperature ], and welding pressure are set up lowness on the other hand in order to avoid such un-arranging, the problem to which the incidence rate of a defective becomes high by poor shaping, layer exfoliation, etc. by poor sticking by pressure of each web material will arise.

[0006]

[Objects of the Invention] This invention to the contact side of the elastic press member which was proposed in order to solve suitably the technical problem mentioned above, and contacts a tray member directly With constituting so that the elastic projected part in which elastic deformation is possible may be prepared by contact of this tray member and a tray member and a layered product may be made to separate into the bottom of an elastic return operation of said elastic projected part from an elastic press member after pressurization termination It aims at offering the pressing equipment which prevents the production degradation of a layered product, the nature fall of mold goods, etc.

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MEANS

[Means for Solving the Problem] In order to solve said technical problem and to attain the desired end this invention The 1st pressurization member which can be held for the tray member for laying the pressing-ed goods to which the laminating of the web material was carried out, enabling free attachment and detachment, It consists of the 2nd pressurization member which prepared the elastic press member equipped with the contact side to which it points in this 1st pressurization member. Make these 1st pressurization member and the 2nd pressurization member approach compulsorily, and said pressing-ed goods by pressurizing homogeneity according to the installation side of said tray member, and the contact side of said elastic press member In the pressing equipment which manufactures the layered product which said each web material stuck mutually In the contact side of said elastic press member, only requirements from an applicable plane of composition in a usual state A projection, When the installation side of said tray member contacts, the elastic projected part which carries out elastic deformation to the level of said contact side by the thrust is prepared. When the pressurization of said layered product is completed and said 1st pressurization member and the 2nd pressurization member are made to estrange, it is characterized by constituting so that said tray member and layered product may be made to separate into the bottom of an elastic return operation of said elastic projected part from the contact side of said elastic press member.

[0008]

[Embodiment of the Invention] Next, about the pressing equipment concerning this invention, a suitable example is given, and it explains below, referring to an accompanying drawing.

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OPERATION

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[An operation of the 1st example] The elastic press member 30 which comes in one to fabricate the elastic projected part 45 with the pressing equipment 10 of the 1st example constituted as mentioned above to the contact side 32 of a body 31 is fixed to said buttress plate 40 by the basis which carried out vulcanization adhesion extensively in the crevice 26 for wearing of the punch body 25 in a punch 13 using a mounting bolt 42 using heat-resistant adhesives etc. Thereby, the condition of having pointed to the installation section 21 in said female mold 12 is equipped with the elastic press member 30.

[0018] And said tray member 50 which set to the installation side 51 the pressing-ed goods S which come to carry out the laminating of the ceramic green sheet by the basis installed in the production line By controlling said hydrostatic pressure cylinder 14 so that rod 14a moves forward if the pressing-ed goods S are heated by predetermined temperature with said heating means of this female mold 12 after being held with the autoloader equipment which is not illustrated at the installation section 21 of female mold 12 The female mold 12 holding the tray member 50 goes up, and contiguity migration is carried out to said punch 13. At this time, the tray member 50 by which set maintenance was carried out at the installation section 21 of female mold 12 contacts at the tip of each elastic projected part 45 first, and thereby, with the updrift of this female mold 12, each elastic projected part 45 is pressed gradually, and it comes to carry out elastic deformation.

[0019] Furthermore, if said female mold 12 carries out updrift, the pressing-ed goods S will stick first in contact with the contact side 32 of said elastic press member 30, and the installation side 51 of the tray member 50 will come to stick in contact with the applicable plane of composition 32 behind suitably. Said each elastic projected part 45 which deformed at this time comes to constitute a part of applicable plane of composition 32 while it comes to be held completely and does not project at all from said contact side 32 into said concave slot 46, and as shown in drawing 3, it comes to stick it to the installation side 51 of the tray member 50 with said contact side 32.

[0020] And when said female mold 12 arrives at the best location and updrift is completed, predetermined welding pressure is given to female mold 12 and a punch 13 by the energization force of said hydrostatic pressure cylinder 14, and said pressing-ed goods S are pressurized by the contact side 32 of the elastic press member 30, and the installation side 51 of the tray member 50 from the upper and lower sides. \*\*\*\*\* the pressing-ed goods S have the difference in thickness partially or irregularity is shown in a front face at this time -- the installation side 51 of said tray member 50 -- quantity, while being formed flat and smooth Since elastic deformation is carried out so that the contact side 32 of said elastic press member 30 may follow in the shape of [ of the pressing-ed goods S ] surface type The ceramic layered product T by which each ceramic green sheet stuck the pressing-ed goods S mutually when the vertical both sides were pressurized by homogeneity and set up whenever [ stoving temperature ], and welding pressure appropriately comes to be fabricated suitably.

[0021] controlling said hydrostatic pressure cylinder 14 so that rod 14a retreats if shaping of the ceramic layered product T is completed by pressurizing the pressing-ed goods S -- female mold 12 -- downward initiation -- carrying out -- from a punch 13 -- gradually -- alienation -- it comes to move and the pressurization to the tray member 50 and the fabricated ceramic layered product T is canceled gradually. Since it acts at this time so that the return elasticity of each elastic projected part 45 may press said tray member 50 below, this tray member 50 is separated into the bottom of an elastic return operation of this elastic projected part 45 from the elastic press member 30. in addition, the return elasticity of each elastic projected part 45 -- the tray member 50 -- acting (since each elastic projected part 45 not touching the ceramic layered product T) -- since the adhesion force of this layered product T and the tray member 50 is stronger than the adhesion



force of this layered product T and the elastic press member 30, this ceramic layered product T is separated from the contact side 32 of the elastic press member 30, stuck to the tray member 50.

[0022] Thus, when the energization to female mold 12 and a punch 13 is canceled after shaping of the ceramic layered product T, the tray member 50 and the ceramic layered product T can be made to separate into the bottom of an elastic return operation of each elastic projected part 45 prepared in the elastic press member 30 from this elastic press member 30 certainly with the pressing equipment 10 concerning the 1st example. Being held by this, while the tray member 50 and the ceramic layered product T had stuck to the elastic press member 30 after shaping is avoided suitably, and it does not invite the production degradation by halt of the whole production line. Moreover, even if it raises whenever [ by said heating means / stoving temperature ] or fabricates by the basis which raised welding pressure, the tray member 50 and the ceramic layered product T can be made to separate from the elastic press member 30 certainly after shaping, poor sticking by pressure and poor shaping of each web material, layer exfoliation, etc. are avoided suitably, and upgrading of a ceramic layered product can be planned.

[0023] Moreover, by establishing the concave slot 46 in the perimeter of the elastic projected part 45, the elastic projected part 45 which deformed by press of the tray member 50 deforms so that it may hold in this concave slot 46, and the return elasticity beyond the need is not given at the time of shaping. And if the volume of lobe part 45a of the elastic projected part 45 projected from the contact side 32 is set up identically to the volume of said concave slot 46 thru/or a little small, in case the tray member 50 will stick it to the contact side 32 of the elastic press member 30 extensively, the elastic projected part 45 which deformed is completely held into said concave slot 46, and does not check adhesion of both the members 30 and 50.

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## EXAMPLE

[The 1st example] Drawing 5 is the outline block diagram showing a part of pressing equipment concerning the 1st example of this invention in the condition of having fractured. The pressing equipment 10 of this 1st example the frame 11 of the shape of a rectangle frame fixed to the necessary location of the production line which is not illustrated — receiving — rise and fall — it consists of female mold 12 as the 1st pressurization member arranged movable, and a punch 13 as the 2nd pressurization member fixed to the inside upper part of said frame 11.

[0010] Said female mold 12 makes a subject the body 20 of female mold of the shape of a flat-surface rectangle fixed at the tip of rod 14a of the hydrostatic pressure cylinder (for example, oil hydraulic cylinder) 14 installed in said frame 11 bottom. (Female mold) If said hydrostatic pressure cylinder 14 is controlled so that rod 14a moves forward, it will go up in the state of a horizontal position, and contiguity migration will be carried out to said punch 13, and if this hydrostatic pressure cylinder 14 is controlled so that rod 14a retreats, it will descend in the state of a horizontal position, and will estrange from said punch 13. And while the installation section 21 which can hold the rectangle tabular tray member 50 which moves along with a production line free [ attachment and detachment ] in the level condition is formed in the top face of the body 20 of female mold, a heating means (not shown) to heat the pressing-ed goods S laid in said tray member 50 to predetermined temperature is laid under the interior of this body 20 of female mold. In addition, as a heating means, a heating-wire heater, the heat pipe with which a heat carrier circulates, a heat plate, etc. are adopted suitably. Moreover, it is automatically detached [ the tray member 50 / when said female mold 12 has stopped in the lowest location ] and attached to the installation section 21 by the autoloader equipment which is not illustrated.

[0011] (Tray member) As said tray member 50 is shown in drawing 1 and drawing 5 , from said pressing-ed goods S, suitably, it is the plate-like part material set up greatly, and the installation side 51 for laying these pressing-ed goods S is formed in high smoothness. When the smoothness of said installation side 51 is illustrated concretely, if the "flatness" measured based on JISB0601 is possible, its 0.01mm or less is desirable at least 0.04mm or less. Moreover, at least 0.4 "micrometers of surface roughness" or less is preferably set to 0.1 micrometers.

[0012] (Punch) It is fixed to the crevice 26 for wearing formed by this punch body [ which is fixed to the inside upper part in said frame 11 using the bolt which is not illustrated ] 25, and punch body 25 bottom, and said punch 13 consists of elastic press members 30 with which it was equipped so that it might point to the installation section 21 of said female mold 12. Said elastic press member 30 is firmly fixed to the buttress plate 40 which makes nonferrous metals, such as steel or aluminum, the quality of the material by said crevice 26 for wearing by carrying out vulcanization adhesion extensively using heat-resistant adhesives etc., \*\*\*\*ing the mounting bolt 42 inserted in from the upper part of said punch body 25, and stuffing a hole 41. In addition, in said elastic press member 30 fixed to the punch body 25, it is set up so that it may counter horizontally [ the contact side 32 which pointed to the lower part, and the installation side 51 of the tray member 50 by which set maintenance is carried out at the installation section 21 of said female mold 12 ], and in parallel.

[0013] (Elastic press member) And said elastic press member 30 in the pressing equipment 10 of the 1st example makes the subject the tabular body 31 fabricated by necessary thickness in the shape of a flat-surface abbreviation rectangle from the flexible spring material which has elasticity, as shown in drawing 1 and drawing 2 . This body 31 is set as the size which it is set up suitably more greatly than the flat-surface size of said tray member 50, and is stuck to the inner skin of frame-like perpendicular wall 25a in said punch body 25. Moreover, when hold immobilization is carried out, thickness h of a body 31 is set as said crevice 26 for wearing so that it may become the height and abbreviation identitas of said frame-like perpendicular wall 25a including the

thickness of said buttress plate 40. As durable conditions for the elastic press member 30, as for these maximum pressure resistance and the maximum heatproof temperature, 1,200kg/cm<sup>2</sup> or more and the maximum heatproof temperature are not required of coincidence for it here, although the maximum pressure resistance is made into 300 degrees C or more.

[0014] (Elastic projected part) And in the elastic press member 30 of the 1st example, the conic elastic projected part [ two or more (an example eight pieces) ] 45 in which only requirements project below from the applicable plane of composition 32 is formed [ the usual state ] in said contact side 32 formed in the inferior surface of tongue of said body 31 in one at this body 31. As shown in drawing 1 , when it is prepared in the location which does not interfere in said pressing-ed goods S which are the locations which contact said tray member 50, and were laid in this tray member 50 and said installation side 51 of the tray member 50 contacts, elastic deformation of each [ these ] elastic projected part 45 is carried out to the level of said contact side 32 by the thrust ( drawing 3 ). And if elastic deformation of each elastic projected part 45 is carried out by contact of the tray member 50, the return elasticity which is going to carry out a configuration return to the original protrusion condition will occur, and it will act so that this may make this tray member 50 separate from the elastic press member 30. Therefore, with the pressing equipment 10 of the 1st example, when female mold 12 is made to estrange from said punch 13 after pressurization termination of a layered product T, it may have comes to separate said tray member 50 and layered product T into the bottom of an elastic return operation of each elastic projected part 45 from the contact side 32 of said elastic press member 30.

[0015] Moreover, when the annular concave slot (crevice) 46 facing the perimeter said each elastic projected part 45 of every is formed and said tray member 50 contacts the elastic projected part 45, elastic deformation is carried out to the contact side 32 of the body 31 in said elastic press member 30 to the concave slot 46 where this elastic projected part 45 adjoins. And in said elastic projected part 45, it is set up identically to the volume of said concave [ which was projected outside from the contact side 32 of said body 31 ] slot 46 in which the volume of partial 45a was cut from the applicable plane of composition 32 by projecting inside thru/or a little small. Therefore, when the tray member 50 comes to stick to the contact side 32 of the elastic press member 30 extensively, said elastic projected part 45 which carried out elastic deformation is completely held into said concave slot 46, and it is set up so that it may not project at all from the contact side 32. Moreover, the air guide rail 34 the edge section of each concave slot 46 and the edge section of a body 31 are connected [ air ] is formed in said contact side 32, the tray member 50 sticks to this body 31, the elastic projected part 45 can face holding to said concave slot 46, and \*\*\*\*\* guidance of the air which remains in this concave slot 46 can be carried out now to the exterior.

[0016] In addition, the material with which said elastic press member 30 has proper elasticity, such as special synthetic rubber, such as natural rubber, diene rubber, olefin rubber, acrylic nitril butadiene rubber, silicone rubber, a fluororubber, chlorosulfonated polyethylene, chlorinated polyethylene, chlorinated butyl rubber, polysulfide rubber, polyurethane rubber, acrylic rubber, epichlorohydrin rubber, polypropylene oxide, and an ethylene vinyl acetate polymer, and thermoplastic elastomer, may be adopted.

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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] It is the bottom view which saw the elastic press member carried out by the pressing equipment concerning the 1st example from the contact side side.

[Drawing 2] It is the II-II line sectional view of drawing 1 .

[Drawing 3] By giving thrust to the elastic press member and tray member which are shown in drawing 2 , it is the fragmentary sectional view showing the condition of pressurizing the pressing-ed goods laid in this tray member.

[Drawing 4] When an elastic press member and a tray member are made to estrange after pressurization termination, it is the fragmentary sectional view showing the condition of having made the tray member and the layered product separating into the bottom of an elastic return operation of an elastic projected part from the contact side of an elastic press member.

[Drawing 5] It is the outline block diagram fracturing and showing a part of pressing equipment of the 1st example equipped with the press elastic member shown in drawing 1 .

[Drawing 6] It is the sectional side elevation of the elastic press member carried out by the pressing equipment concerning the 2nd example.

[Drawing 7] By giving thrust to the elastic press member and tray member which are shown in drawing 6 , it is the fragmentary sectional view showing the condition of pressurizing the pressing-ed goods laid in this tray member.

[Drawing 8] When an elastic press member and a tray member are made to estrange after pressurization termination, it is the fragmentary sectional view showing the condition of having made the tray member and the layered product separating into the bottom of an elastic return operation of an elastic projected part from the contact side of an elastic press member.

[Drawing 9] It is the fragmentary sectional view showing the elastic projected part of the elastic press member concerning the example of modification of the 2nd example.

### [Description of Notations]

12 1st Pressurization Member (Female Mold)

13 2nd Pressurization Member (Punch)

30 Elastic Press Member

32 Contact Side

33 Installation Hole (Installation Section)

44 Securing Bolt (Holddown Member)

45 Elastic Projected Part

45a A part for a lobe

46 Concave Slot

49a Concave slot

49b Space section

50 Tray Member

51 Installation Side

55 Engagement Protruding Piece (1st Engagement Section)

56 Engagement Hole (2nd Engagement Section)

S Pressing-ed goods

T Layered product

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[Translation done.]

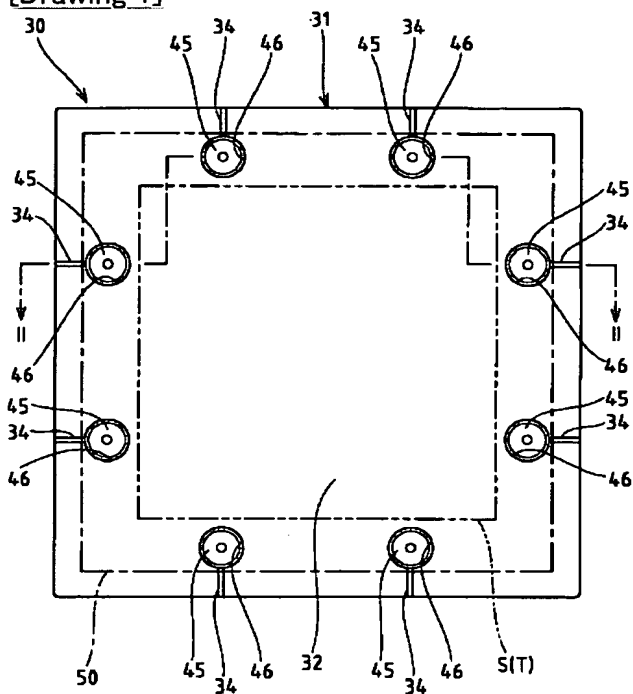
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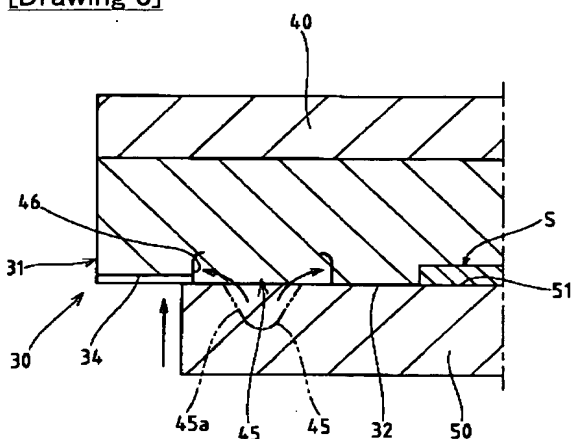
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## DRAWINGS

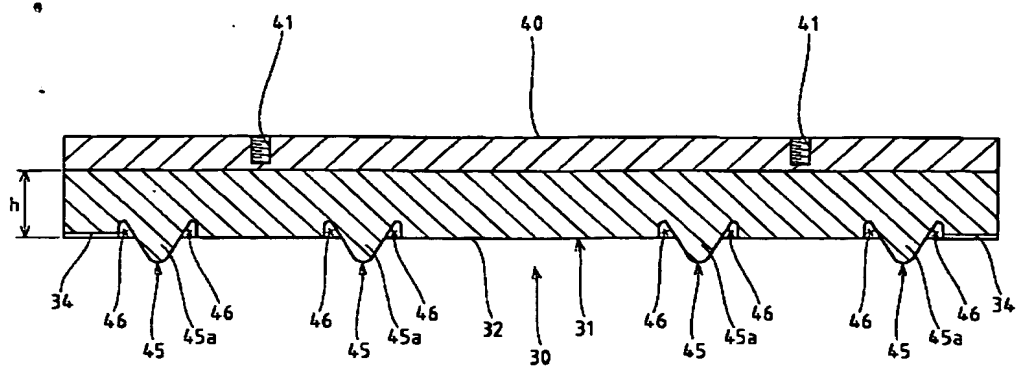
[Drawing 1]



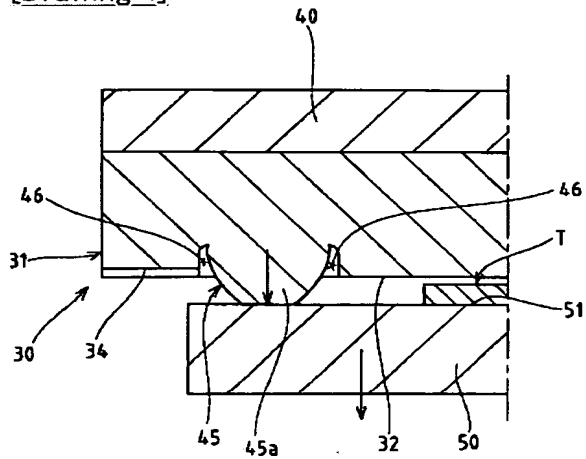
[Drawing 3]



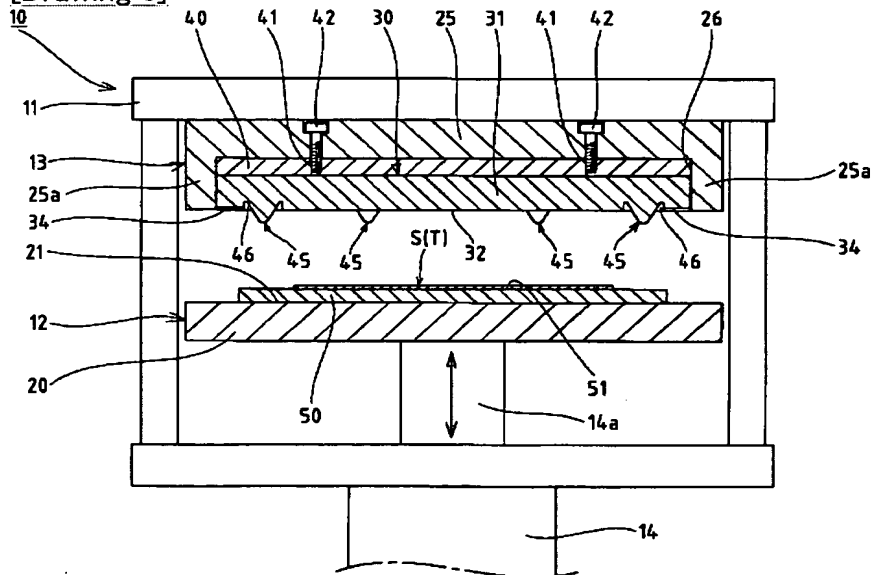
[Drawing 2]



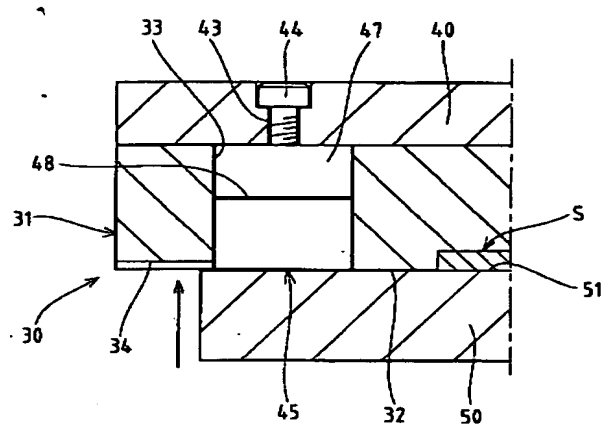
[Drawing 4]



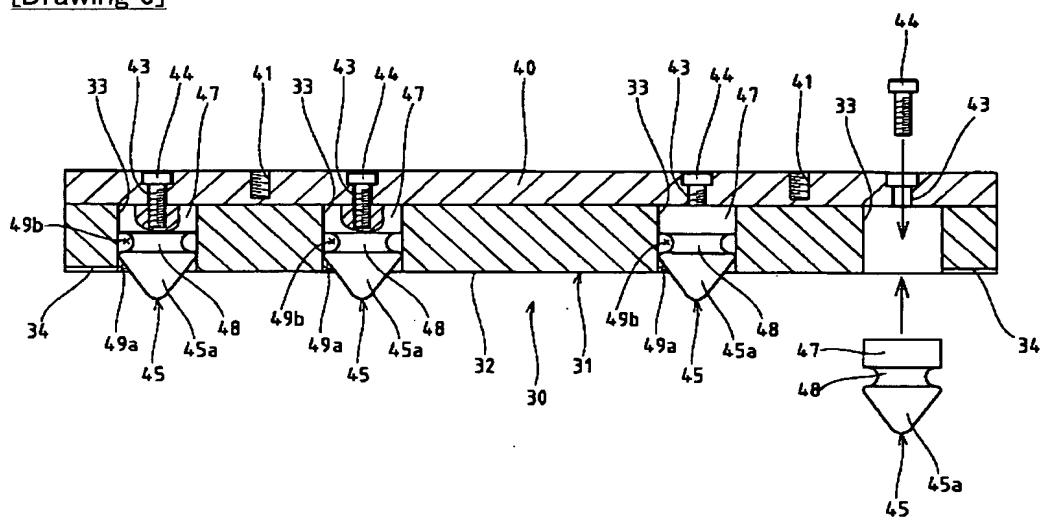
[Drawing 5]



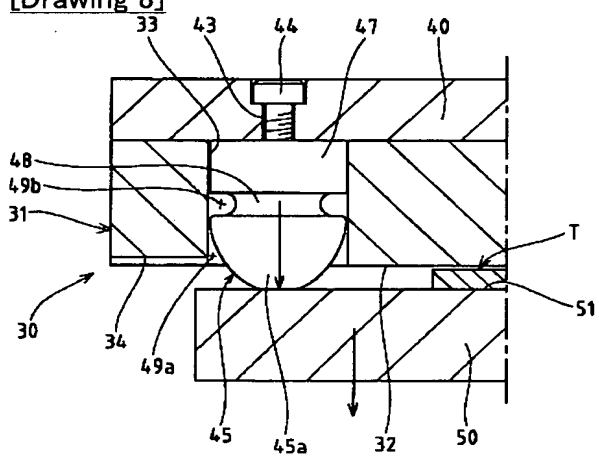
[Drawing 7]



[Drawing 6]

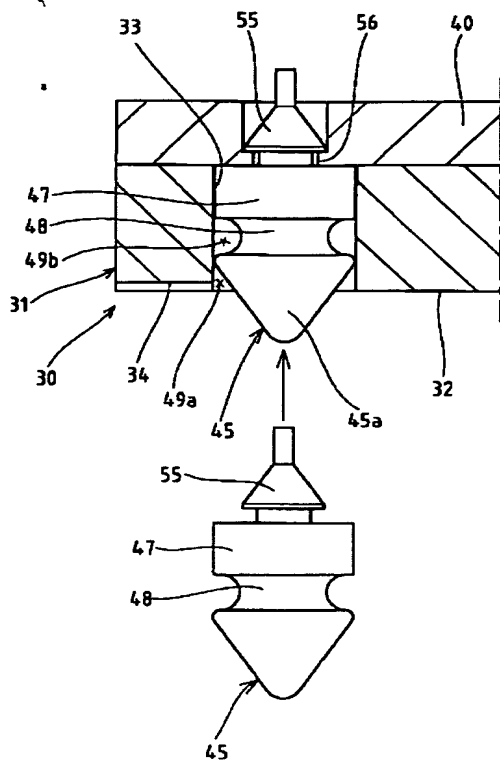


[Drawing 8]



[Drawing 9]





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[Translation done.]

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B 2 8 B 3/02		B 2 8 B 3/02	K 4 G 0 5 4
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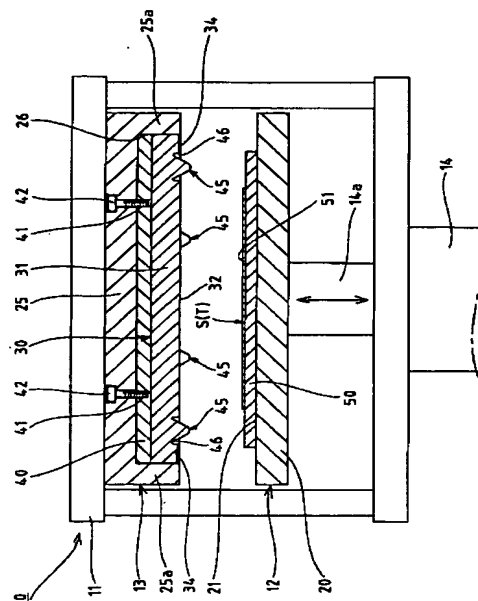
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(54) 【発明の名称】 加圧成形装置

(57) 【要約】

【課題】 積層体の加圧終了後に、トレー部材および該積層体を弾性押圧部材から確実に分離させ得るようにすることで、積層体の生産効率低下および成形品質低下等を防止する。

【解決手段】 第2加圧部材13に設けた弾性押圧部材30の当接面32に、常には当接面32から所要量だけ突出し、第1加圧部材12に保持したトレー部材50の載置面51が当接した際に、その押圧力により当接面32のレベルまで弾性変形する弾性突部45を設ける。積層体Tの加圧が終了して第1加圧部材12および第2加圧部材13を離間させた際に、弾性突部45の弾性復帰作用下に、トレー部材50および積層体Tを弾性押圧部材30の当接面32から分離させる。弾性押圧部材30の当接面32には、弾性突部45の周囲に陥凹凹部46が画成され、トレー部材50に押圧された該弾性突部45は、該凹部46へ弾性変形する。



## 【特許請求の範囲】

【請求項1】 シート材を積層させた被加圧成形物品(5)を載置するためのトレー部材(50)を着脱自在に保持し得る第1加圧部材(12)と、この第1加圧部材(12)に指向する当接面(32)を備える弾性押圧部材(30)を設けた第2加圧部材(13)とからなり、これら第1加圧部材(12)および第2加圧部材(13)を強制的に近接させて、前記トレー部材(50)の載置面(51)および前記弾性押圧部材(30)の当接面(32)により前記被加圧成形物品(5)を均一に加圧することで、前記夫々のシート材が相互に密着した積層体(7)を製造する加圧成形装置において、前記弾性押圧部材(30)の当接面(32)に、常には該当接面(32)から所要量だけ突出し、前記トレー部材(50)の載置面(51)が当接した際に、その押圧力により前記当接面(32)のレベルまで弾性変形する弾性突部(45)を設け、前記積層体(7)の加圧が終了して前記第1加圧部材(12)および第2加圧部材(13)を離間させた際に、前記弾性突部(45)の弾性復帰作用下に、前記トレー部材(50)および積層体(7)を前記弾性押圧部材(30)の当接面(32)から分離させ得るよう構成したことを特徴とする加圧成形装置。

【請求項2】 前記弾性押圧部材(30)の当接面(32)には、前記弾性突部(45)の周囲に臨む凹部(46/49a, 49b)が画成され、前記トレー部材(50)に押圧された該弾性突部(45)は、前記凹部(46/49a, 49b)へ弾性変形する請求項1記載の加圧成形装置。

【請求項3】 前記弾性突部(45)において、前記弾性押圧部材(30)の当接面(32)から外側へ突出した突出部分(45a)の体積は、該当接面(32)から内側へ凹設された前記凹部(46/49a, 49b)の容積と同一乃至やや小さく設定され、前記トレー部材(50)が前記当接面(32)へ全面的に密着する際には、弾性変形した前記弾性突部(45)が前記凹部(46/49a, 49b)内へ完全に収容されるようになっている請求項2記載の加圧成形装置。

【請求項4】 前記弾性突部(45)は、前記弾性押圧部材(30)に一体的に形成されている請求項1～3の何れかに記載の加圧成形装置。

【請求項5】 前記弾性突部(45)は、前記弾性押圧部材(30)とは別体に形成され、該弾性押圧部材(30)に設けた設置部(33)に設置固定される請求項1～3の何れかに記載の加圧成形装置。

【請求項6】 前記弾性突部(45)は、適宜の固定部材(44)を利用して前記弾性押圧部材(30)に対して着脱可能に設置される請求項5記載の加圧成形装置。

【請求項7】 前記弾性突部(45)は、該弾性突部(45)に一体的に設けた第1係着部(55)および前記弾性押圧部材(30)側に設けた第2係着部(56)との相互係着下に、該弾性押圧部材(30)に着脱可能に設置される請求項5記載の加圧成形装置。

【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】この発明は、加圧成形装置に関し、更に詳細には、第1加圧部材に保持したトレー部材および第2加圧部材に設けた弾性押圧部材で該トレー部材に載置した被加圧成形物品を均一に加圧することで、シート材が相互に密着した積層体を成形する加圧成形装置の改良に関するものである。

## 【0002】

【従来の技術】例えば、セラミックス積層体として、積層セラミックス基板や積層セラミックスコンデンサ等が知られていると共に広く実施に供されている。このうち積層セラミックス基板は、複数のセラミックスの薄層および該薄層の間に配線パターンを形成した構造を呈し、また積層セラミックスコンデンサは、セラミックスの薄層と薄膜状の内部電極とを交互に積層した構造を呈している。このようなセラミックス積層体は、一面に配線パターンまたは内部電極を印刷形成した複数のセラミックスグリーンシートを積層した被加圧成形物品を、例えば特開平2000-79611号公報に開示の加圧成形用型を使用した加圧成形装置で加圧することにより、各シート材が相互に密着した状態に成形されるようになって

いる。

【0003】前記公報に開示の加圧成形用型は、上面における中央部に被加圧成形物品が載置される第1加圧部材(下型)と、柔軟性を有する塊状弾性部材(以下「弾性押圧部材」という)を装着した第2加圧部材(上型)とから構成されて、前記第1加圧部材の上面に被加圧成形物品を載置したもて、該第1加圧部材を前記第2加圧部材に強制的に近接させることで、該被加圧成形物品を均一に加圧するようになっている。すなわち被加圧成形物品は、第1加圧部材の載置面と前記弾性押圧部材の当接面とで上下から加圧され、これにより各セラミックスグリーンシートが相互に密着してセラミックス積層体を成形するものである。ここで、前記セラミックスグリーンシートには、前述した如く配線パターンや内部電極が形成されているため、複数の該シートを積層してなる前記被加圧成形物品では、厚みが部分的に異なると共に表面に微妙な凹凸が形成されている。このため前記加圧成形用型では、第1加圧部材の載置面の平滑度を高めると共に、柔軟性を有する弾性押圧部材を第2加圧部材に装着することにより、加圧成形時には該弾性押圧部材が被加圧成形物品の表面形状に追従変形することで、均一な加圧を可能としている。なお、前記被加圧成形物品に対する加熱温度や加圧力(挟圧力)を高める程に、高品質のセラミックス積層体を成形し得る。

## 【0004】

【発明が解決しようとする課題】ところで、前記セラミックス積層体の製造ラインでは、前記被加圧成形物品および成形されたセラミックス積層体が、該ラインに沿って移動するトレー部材に載置した状態で移送されるよう

になっている。従って、前記公報に開示の加圧成形用型を装備した加圧成形装置を、セラミックス積層体の製造ラインで実施に供する場合は、前記被加圧成形物品を載置したトレー部材を、前記第1加圧部材の上面に着脱自在に保持する形態が採られる。このため実際には、前記トレー部材の載置面の平滑度を高めておき、前記第1加圧部材および第2加圧部材を強制的に近接させた際には、該トレー部材の載置面および前記弾性押圧部材の当接面で前記被加圧成形物品を均一に加圧することになる。このような成形形態にあっても、前記トレー部材の載置面の平滑度を高めておくことにより、良好なセラミックス積層体の成形は可能である。

【0005】しかしながら、前述したトレー部材を使用する場合には、次の如き新たな問題が発生していた。すなわち前記トレー部材の載置面は、少なくとも前記被加圧成形物品よりも大きく設定されているため、該被加圧成形物品に接触していない載置面の部分は、前記弾性押圧部材の当接面と直接的に接触して密着するようになる。ところが前記加圧成形用型は、前述した如く、被加圧成形物品を加熱するために数百℃に加熱保温されると共に数十トンの加圧力が付与されるから、互いに密着した弾性押圧部材とトレー部材とはその密着力がかなり高まり、加圧終了後に第2加圧部材から第1加圧部材を離間させても、成形されたセラミックス積層体およびトレー部材が弾性押圧部材の当接面に密着したままとなる不都合があった。しかも、この密着現象は、加熱温度が高くなる程に顕著に現れと共に加圧力が高くなる程に顕著に現れ、換言すると良好な積層体を成形しようとする程に顕著に現れていた。このため、第2加圧部材(弾性押圧部材)にセラミックス積層体およびトレー部材が密着されたままとなった場合は、製造ライン全体を一時的に停止にして当該トレー部材および積層体の取外し作業を行なうことになり、生産効率低下を招来する問題が生ずる。一方、このような不都合を回避するべく加熱温度や加圧力を低めに設定した場合には、各シート材の圧着不良による成形不良や層剥離等により不良品の発生率が高くなってしまいう問題が生じてしまう。

【0006】

【発明の目的】本発明は、前述した課題を好適に解決するべく提案されたもので、トレー部材に直接的に接触する弾性押圧部材の当接面に、該トレー部材の当接により弾性変形可能な弾性突部を設けておき、加圧終了後には前記弾性突部の弾性復帰作用下に、トレー部材および積層体を弾性押圧部材から分離させ得よう構成することで、積層体の生産効率低下および成形品質低下等を防止する加圧成形装置を提供することを目的とする。

【0007】

【課題を解決するための手段】前記課題を解決して、所期の目的を達成するため本発明は、シート材を積層させた被加圧成形物品を載置するためのトレー部材を着脱自

在に保持し得る第1加圧部材と、この第1加圧部材に指向する当接面を備える弾性押圧部材を設けた第2加圧部材とからなり、これら第1加圧部材および第2加圧部材を強制的に近接させて、前記トレー部材の載置面および前記弾性押圧部材の当接面により前記被加圧成形物品を均一に加圧することで、前記夫々のシート材が相互に密着した積層体を製造する加圧成形装置において、前記弾性押圧部材の当接面に、常には該当接面から所要量だけ突出し、前記トレー部材の載置面が当接した際に、その押圧力により前記当接面のレベルまで弾性変形する弾性突部を設け、前記積層体の加圧が終了して前記第1加圧部材および第2加圧部材を離間させた際に、前記弾性突部の弾性復帰作用下に、前記トレー部材および積層体を前記弾性押圧部材の当接面から分離させ得よう構成したことを特徴とする。

【0008】

【発明の実施の形態】次に、本発明に係る加圧成形装置につき、好適な実施例を挙げて、添付図面を参照しながら以下説明する。

【0009】

【第1実施例】図5は、本発明の第1実施例に係る加圧成形装置を、一部破断した状態で示す概略構成図であって、この第1実施例の加圧成形装置10は、図示しない製造ラインの所要位置に固定された矩形枠体状のフレーム11に対し、昇降移動可能に配設された第1加圧部材としての下型12と、前記フレーム11の内側上方に固定された第2加圧部材としての上型13とから構成されている。

【0010】(下型)前記下型12は、前記フレーム11の下側に設置された流体圧シリンダ(例えば油圧シリンダ)14のロッド14a先端に固定された平面矩形形状の下型本体20を主体とし、前記流体圧シリンダ14をロッド14aが前進するよう制御すれば水平姿勢状態で上昇して前記上型13へ近接移動し、該流体圧シリンダ14をロッド14aが後退するよう制御すれば水平姿勢状態で下降して前記上型13から離間するようになっている。そして下型本体20の上面には、製造ラインに沿って移動する矩形板状のトレー部材50を水平状態で着脱自在に保持し得る載置部21が形成されていると共に、該下型本体20の内部には、前記トレー部材50に載置された被加圧成形物品Sを所定温度に加熱する加熱手段(図示せず)が埋設されている。なお加熱手段としては、電熱線ヒータ、熱媒が流通する熱パイプ、熱プレート等が好適に採用される。またトレー部材50は、前記下型12が最下位置に停止している際に、図示しない自動ローダ装置によって載置部21に対して自動的に着脱される。

【0011】(トレー部材)前記トレー部材50は、図1および図5に示す如く、前記被加圧成形物品Sよりも適宜大きく設定された板状部材であって、該被加圧成形物

品Sを載置するための載置面51が、高い平滑度に形成されている。前記載置面51の平滑度を具体的に例示すると、JISB0601に準拠して測定された「平面度」は、少なくとも0.04mm以下、可能であれば0.01mm以下が好ましい。また「表面粗さ」は、少なくとも0.4μm以下、好ましくは0.1μmとされる。

【0012】(上型)前記上型13は、図示しないボルト等を利用して前記フレーム11における内側上部に固定される上型本体25と、この上型本体25の下側に画成された装着用凹部26に固定され、前記下型12の載置部21を指向するように装着された弾性押圧部材30とから構成されている。前記弾性押圧部材30は、例えば銅またはアルミニウム等の非鉄金属を材質とする支持プレート40に、耐熱接着剤等を利用して全面的に加硫接着され、前記上型本体25の上方から挿通した取付ボルト42をねじ孔41へねじ込むことにより、前記装着用凹部26に強固に固定される。なお、上型本体25に固定された前記弾性押圧部材30では、下方を指向した当接面32と、前記下型12の載置部21にセット保持されるトレー部材50の載置面51とは、水平かつ平行に対向するように設定されている。

【0013】(弾性押圧部材)そして、第1実施例の加圧成形装置10における前記弾性押圧部材30は、図1および図2に示す如く、弾性を有する柔軟弾性材料から所要厚で平面略矩形状に成形された板状本体31を主体としている。この本体31は、前記トレー部材50の平面サイズよりも適宜大きく設定され、かつ前記上型本体25における枠状垂直壁25aの内周面に密着するサイズに設定されている。また本体31の厚みhは、前記装着用凹部26に収容固定した際に、前記支持プレート40の厚みを含めて前記枠状垂直壁25aの高さと略同一になるように設定されている。ここで弾性押圧部材30の耐久条件としては、最大耐圧強度が1,200kg/cm<sup>2</sup>以上、最大耐熱温度が300℃以上とされるが、これら最大耐圧強度および最大耐熱温度は同時に要求されるものではない。

【0014】(弾性突部)そして、第1実施例の弾性押圧部材30では、前記本体31の下面に形成された前記当接面32に、常には該当接面32から所要量だけ下方へ突出する複数個(実施例では8個)の円錐状の弾性突部45が、該本体31に一体的に形成されている。これら各弾性突部45は、図1に示す如く、前記トレー部材50に当接する位置で、かつ該トレー部材50に載置された前記被加圧成形物品Sに干渉しない位置に設けられており、トレー部材50の前記載置面51が当接した際に、その押圧力により前記当接面32のレベルまで弾性変形するようになっている(図3)。そして各弾性突部45は、トレー部材50の当接により弾性変形すると、元の突出状態へ形状復帰しようとする復帰弾力が発生し、これが該トレー部材50を弾性押圧部材30から分離させ

るように作用する。従って第1実施例の加圧成形装置10では、積層体Tの加圧終了後に前記上型13から下型12を離間させた際に、夫々の弾性突部45の弾性復帰作用下に、前記トレー部材50および積層体Tを前記弾性押圧部材30の当接面32から分離させ得ようになっている。

【0015】また、前記弾性押圧部材30における本体31の当接面32には、前記夫々の弾性突部45毎にその周囲に臨む環状の凹状溝部(凹部)46が画成され、前記トレー部材50が弾性突部45に当接した際には、該弾性突部45が隣接する凹状溝部46へ弾性変形する。しかも、前記弾性突部45において、前記本体31の当接面32から外側へ突出した突出部分45aの体積は、該当接面32から内側へ凹設された前記凹状溝部46の容積と同一乃至やや小さく設定されている。従って、トレー部材50が弾性押圧部材30の当接面32に全面的に密着するようになった場合には、弾性変形した前記弾性突部45が前記凹状溝部46内へ完全に収容され、当接面32から全く突出しないように設定されている。また前記当接面32には、夫々の凹状溝部46の端縁部と本体31の端縁部とを接続する空気案内溝34が形成されており、該本体31にトレー部材50が密着して前記凹状溝部46へ弾性突部45が収容されるに際し、該凹状溝部46内に残存する空気を外部へ通出案内し得ようになっている。

【0016】なお、前記弾性押圧部材30は、例えば天然ゴム、ジェンゴム、オレフィンゴム、アクリルニトリルブタジエンゴム、シリコンゴム、フッ素ゴム、クロロスルホン化ポリエチレン、塩素化ポリエチレン、塩素化ブチルゴム、多硫化ゴム、ウレタンゴム、アグリルゴム、エピクロルヒドリンゴム、ポリプロピレンオキシド、エチレン酢酸ビニル重合体等の特殊合成ゴム、および熱可塑性エラストマー等、適宜の弾性を有する素材が採用され得る。

【0017】

【第1実施例の作用】前述のように構成された第1実施例の加圧成形装置10では、本体31の当接面32に弾性突部45を一体的に成形してなる弾性押圧部材30を、耐熱接着剤等を利用して前記支持プレート40に全面的に加硫接着したもとの、取付ボルト42を利用して上型13における上型本体25の装着用凹部26に固定する。これにより弾性押圧部材30は、前記下型12における載置部21を指向した状態に装着される。

【0018】そして、製造ラインに設置したもとの、セラミックスグリーンシートを積層してなる被加圧成形物品Sを載置面51にセットした前記トレー部材50が、図示しない自動ロード装置で下型12の載置部21に保持された後、該下型12の前記加熱手段により被加圧成形物品Sが所定温度に加熱されたら、前記流体圧シリンダ14をロッド14aが前進するよう制御することで、

トレー部材 50 を保持した下型 12 が上昇して前記上型 13 へ近接移動する。このとき、下型 12 の載置部 21 にセット保持されたトレー部材 50 は、まず各弾性突部 45 の先端に接触し、これにより夫々の弾性突部 45 は、該下型 12 の上昇移動と共に徐々に押圧されて弾性変形するようになる。

【0019】更に前記下型 12 が上昇移動すると、先ず被加圧成形物品 S が前記弾性押圧部材 30 の当接面 32 に当接して密着し、そして適宜後にトレー部材 50 の載置面 51 が該当接面 32 に当接して密着するようになる。このとき変形した前記夫々の弾性突部 45 は、前記凹状溝部 46 内へ完全に収容されるようになり、前記当接面 32 から全く突出しないと共に該当接面 32 の一部を構成するようになり、図 3 に示す如く、前記当接面 32 と共にトレー部材 50 の載置面 51 に密着するようになる。

【0020】そして、前記下型 12 が最上位置へ到来して上昇移動が完了した際には、前記流体圧シリンダ 14 の付勢力により下型 12 および上型 13 に所定の加圧力が付与され、前記被加圧成形物品 S は、弾性押圧部材 30 の当接面 32 およびトレー部材 50 の載置面 51 により上下から加圧される。このとき、被加圧成形物品 S が部分的に厚みの差異があったり表面に凹凸があったとしても、前記トレー部材 50 の載置面 51 が高平滑に形成されていると共に、前記弾性押圧部材 30 の当接面 32 が被加圧成形物品 S の表面形状に追従するように弾性変形するので、被加圧成形物品 S はその上下両面が均一に加圧され、加熱温度および加圧力を適切に設定しておくことにより、各セラミックスグリーンシートが相互に密着したセラミックス積層体 T が好適に成形されるに至る。

【0021】被加圧成形物品 S を加圧することによりセラミックス積層体 T の成形が完了したら、前記流体圧シリンダ 14 をロッド 14a が後退するよう制御することにより、下型 12 は下降開始して上型 13 から徐々に離間移動するようになり、トレー部材 50 および成形されたセラミックス積層体 T に対する加圧が徐々に解除される。このとき、各弾性突部 45 の復帰弾力が前記トレー部材 50 を下方へ押圧するように作用するので、この弾性突部 45 の弾性復帰作用下に、該トレー部材 50 が弾性押圧部材 30 から分離される。なお、夫々の弾性突部 45 の復帰弾力はトレー部材 50 にのみ作用する(各弾性突部 45 はセラミックス積層体 T に接触していないため)が、該積層体 T とトレー部材 50 との密着力が、該積層体 T と弾性押圧部材 30 との密着力よりも強い場合、該セラミックス積層体 T はトレー部材 50 に密着したまま弾性押圧部材 30 の当接面 32 から分離する。

【0022】このように第 1 実施例に係る加圧成形装置 10 では、セラミックス積層体 T の成形後に下型 12 および上型 13 に対する付勢を解除した際に、弾性押圧部

材 30 に設けた各弾性突部 45 の弾性復帰作用下に、トレー部材 50 およびセラミックス積層体 T を該弾性押圧部材 30 から確実に分離させることができる。これにより、成形後にトレー部材 50 およびセラミックス積層体 T が弾性押圧部材 30 に密着したまま保持されることが好適に回避され、製造ライン全体の一時停止による生産効率低下を招来することがない。また、前記加熱手段による加熱温度を上昇させたり、加圧力を上昇させたもので成形を行なったとしても、成形後にトレー部材 50 およびセラミックス積層体 T を弾性押圧部材 30 から確実に分離させることができ、各シート材の圧着不良や成形不良および層剥離等が好適に回避されてセラミックス積層体の品質向上を図り得る。

【0023】また、弾性突部 45 の周囲に凹状溝部 46 を設けておくことにより、トレー部材 50 の押圧により変形した弾性突部 45 はこの凹状溝部 46 に収容されるように変形し、成形時に必要以上の復帰弾力が付与されない。しかも、当接面 32 から突出した弾性突部 45 の突出部分 45a の体積を、前記凹状溝部 46 の容積と同一乃至やや小さく設定しておけば、トレー部材 50 が弾性押圧部材 30 の当接面 32 に全面的に密着する際には、変形した弾性突部 45 は前記凹状溝部 46 内へ完全に収容され、両部材 30, 50 の密着を阻害しない。

【0024】

【第 2 実施例】図 6 は、本発明の第 2 実施例に係る加圧成形装置に実施される弾性押圧部材を示す側断面図である。なお第 2 実施例の加圧成形装置は、前記第 1 実施例と比較して、弾性押圧部材 30 の形態のみが異なるだけであるから、この弾性押圧部材についてののみ図示し、これ以外の部材は同一の符号を付して説明は省略する。

【0025】第 2 実施例の弾性押圧部材 30 は、図 6 に示す如く、本体 31 および各弾性突部 45 を、夫々別体に形成したものである。すなわち本体 31 には、前記トレー部材 50 に当接する位置で、かつ該トレー部材 50 に載置された前記被加圧成形物品 S に干渉しない位置に、別体成形された弾性突部 45 の形状・サイズを前提とした円形通孔状の設置孔(設置部)33 が複数個(実施例では 8 個)開設されている。また前記支持プレート 40 には、各設置孔 33 に対応したボルト挿通孔 43 が開設されている。なお、本体 31 の形状・サイズおよび材質は、第 1 実施例の弾性押圧部材 30 と同一である。

【0026】一方、前記夫々の弾性突部 45 は、前記設置孔 33 に嵌合される円形状の支持部 47 の端部に小径部 48 を介して一体的に成形されている。そして、対応の設置孔 33 に嵌合した前記支持部 47 を、ボルト挿通孔 43 に挿通した固定ボルト(固定部材)44 で支持プレート 40 に固定することで、前記弾性突部 45 は当接面 32 から適宜突出するように設定されている。従って、前記トレー部材 50 の前記載置面 51 が当接した際には、その押圧力により前記当接面 32 と同一高さまで弾

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性変形し、これにより元の突出状態へ形状復帰しようとする復帰弾力が発生するので、トレー部材50を付勢するようになる。

【0027】また、弾性突部45の周囲には適宜の凹状溝部49aが画成されると共に、前記小径部48の周囲には別の空間部49bが画成されており、前記トレー部材50の載置面51と前記弾性押圧部材30の当接面32とが互いに密着した際には、該弾性突部45が前記凹状溝部49aおよび空間部49bを満たすように弾性変形する(図7)。しかも、前記弾性突部45において、前記本体31の当接面32から外側へ突出した突出部分45aの体積は、前記凹状溝部49aおよび空間部49bを合計した容積と同一乃至やや小さく設定されている。従って、トレー部材50が当接した際には、弾性変形した前記弾性突部45が前記凹部49aおよび空間部49b内へ完全に収容され、当接面32から全く突出しない。

【0028】このような弾性押圧部材30を実施した第2実施例に係る加圧成形装置10では、セラミックス積層体Tの成形後に下型12および上型13に対する付勢を解除した際に、弾性押圧部材30に設置した各弾性突部45の弾性復帰作用下に、トレー部材50およびセラミックス積層体Tを該弾性押圧部材30から確実に分離させることができる。これにより、成形後にトレー部材50およびセラミックス積層体Tが弾性押圧部材30に密着して保持されてしまうことが好適に回避され、製造ライン全体の一時停止による生産効率低下を招来することがない。また、前記加熱手段による加熱温度を上昇させたり、加圧力を上昇させたもとで成形を行なったとしても、成形後にトレー部材50およびセラミックス積層体Tを弾性押圧部材30から確実に分離させることができ、各シート材の圧着不良や成形不良および層剥離等が好適に回避されてセラミックス積層体の品質向上を図り得る。

【0029】なお前記弾性突部45は、本体31と別体成形されるので、該本体31と同一材質とすることは勿論、異材質とすることも可能である。例えば、本体31より硬質の弾性材料から形成した場合には、弾性変形時の復帰弾力が大きくなるのでトレー部材50に対する押圧力が増大し、前記本体31より軟質の弾性材料から形成した場合には、弾性変形時の復帰弾力が小さくなるのでトレー部材50に対する押圧力が減少する。また、各設置孔33毎に材質の異なる弾性突部45を設置することも可能である。

【0030】また、長期間に亘って実施に供されて前記各弾性突部45が劣化したり損傷した場合には、該弾性突部45のみを新品と交換可能であるから、ランニングコストの低減が可能となる。

【0031】

【第2実施例の変更例】図9は、図6に示した第2実施

例の変形例に係る弾性押圧部材30の要部断面図である。この変更例では、弾性突部45を本体31と別体に形成することを前提としたもとで、該弾性突部45の前記支持部47の端部に一体的に形成した第1係着部としての係着突片55を、前記支持プレート40に形成した第2係着部としての係着孔56に係着させることにより、当該弾性突部45を設置孔33に設置固定するようにしたものである。この変更例の弾性押圧部材30においても、長期間に亘って実施に供されて前記各弾性突部45が劣化したり損傷した場合には、該弾性突部45のみを新品と交換可能であるから、ランニングコストの低減が可能である。

【0032】なお第1実施例では、本体31に一体的に成形した弾性突部45だけからなる弾性押圧部材30を示し、また第2実施例では、本体31と別体に成形した弾性突部45だけからなる弾性押圧部材30を例示したが、本体31と一体的に形成した弾性突部45および別体に形成した弾性突部45の両方を混在的に設けた弾性押圧部材としてもよい。また前記各実施例では、夫々同一サイズの弾性突部45だけから構成した弾性押圧部材30を例示したが、位置毎に異なるサイズの弾性突部45を設けるようにしてもよい。

【0033】また前記各実施例では、逆三角状の形状とした弾性突部45を例示したが、この弾性突部45の形状はこれに限定されるものではなく、成形後にトレー部材50に対して適切な復帰弾力を付与することを前提として、様々な形状に設定し得る。

【0034】

【発明の効果】以上説明した如く、本発明に係る加圧成形装置によれば、積層体の加圧が終了して第1加圧部材および第2加圧部材を離間させた際に、弾性押圧部材に設けた各弾性突部の弾性復帰作用下に、トレー部材および積層体を該弾性押圧部材の当接面から確実に分離され得る。これにより、積層体の成形後にトレー部材および該積層体が弾性押圧部材に密着したまま保持される不都合が好適に回避され、製造ライン全体の一時停止による生産効率低下を招来することがない有益な効果を奏する。また、被加圧成形物品の加熱温度を上昇させたり、該加圧成形物品に対する加圧力を上昇させたもとで加圧成形を行なっても、成形後にトレー部材および積層体を弾性押圧部材から確実に分離させることができ、積層体の品質向上を図り得る利点もある。また、弾性突部の周囲に凹部を設けておくことにより、トレー部材の押圧により変形した弾性突部はこの凹部に収容されるように変形し、成形時に不要な復帰弾力が付与されない。しかも、当接面から突出した弾性突部の突出部分の体積を、前記凹部の容積と同一乃至やや小さく設定しておけば、トレー部材が弾性押圧部材の当接面に全面的に密着する際には、変形した弾性突部は前記凹部内へ完全に収容され、両部材の密着を阻害しない。なお、弾性押圧部材と

弾性突部は、一体的に成形してもよいし、夫々を別体に成形することも可能である。ここで両者を別体成形とした場合は、夫々を異なる材質の素材から構成することが可能となる一方、弾性突部を取外し可能に装着するようにしておけば、該弾性突部のみの交換が可能となる。

【図面の簡単な説明】

【図1】第1実施例に係る加圧成形装置に実施される弾性押圧部材を当接面側からみた底面図である。

【図2】図1のII-II線断面図である。

【図3】図2に示す弾性押圧部材およびトレー部材に押圧力を付与することにより、該トレー部材に載置された被加圧成形物品を加圧している状態を示す部分断面図である。

【図4】加圧終了後に弾性押圧部材およびトレー部材を離間させた際に、弾性突部の弾性復帰作用下に、トレー部材および積層体を弾性押圧部材の当接面から分離させた状態を示す部分断面図である。

【図5】図1に示した押圧弾性部材を装着した第1実施例の加圧成形装置を、一部破断して示す概略構成図である。

【図6】第2実施例に係る加圧成形装置に実施される弾性押圧部材の側断面図である。

【図7】図6に示す弾性押圧部材およびトレー部材に押圧力を付与することにより、該トレー部材に載置された被加圧成形物品を加圧している状態を示す部分断面図で\*

\*ある。

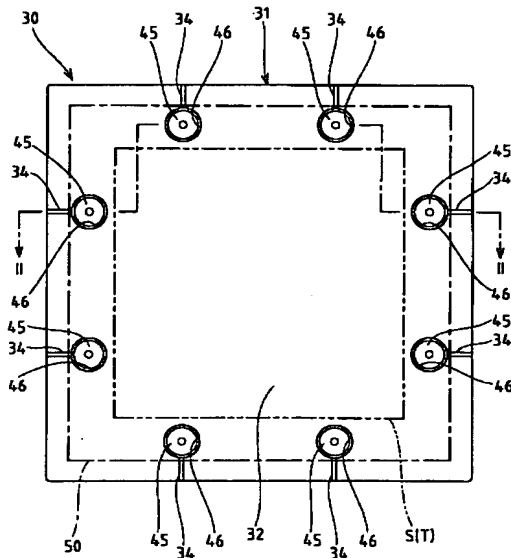
【図8】加圧終了後に弾性押圧部材およびトレー部材を離間させた際に、弾性突部の弾性復帰作用下に、トレー部材および積層体を弾性押圧部材の当接面から分離させた状態を示す部分断面図である。

【図9】第2実施例の変更例に係る弾性押圧部材の弾性突部を示す部分断面図である。

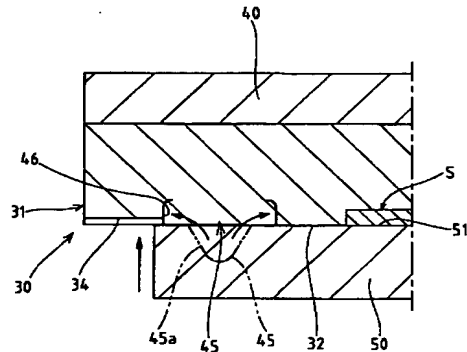
【符号の説明】

- 12 第1加圧部材(下型)
- 13 第2加圧部材(上型)
- 30 弾性押圧部材
- 32 当接面
- 33 設置孔(設置部)
- 44 固定ボルト(固定部材)
- 45 弾性突部
- 45a 突出部分
- 46 凹状溝部
- 49a 凹状溝部
- 49b 空間部
- 50 トレー部材
- 51 載置面
- 55 係着突片(第1係着部)
- 56 係着孔(第2係着部)
- S 被加圧成形物品
- T 積層体

【図1】

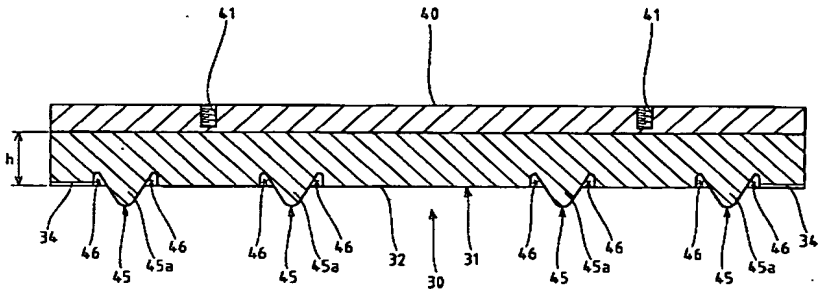


【図3】

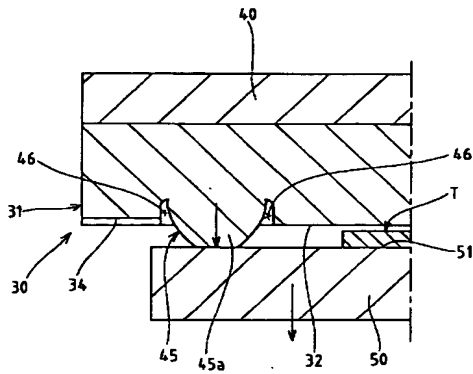




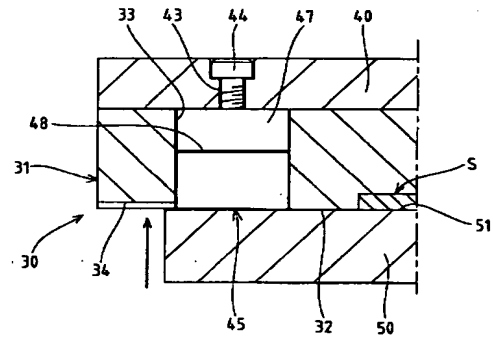
【図2】



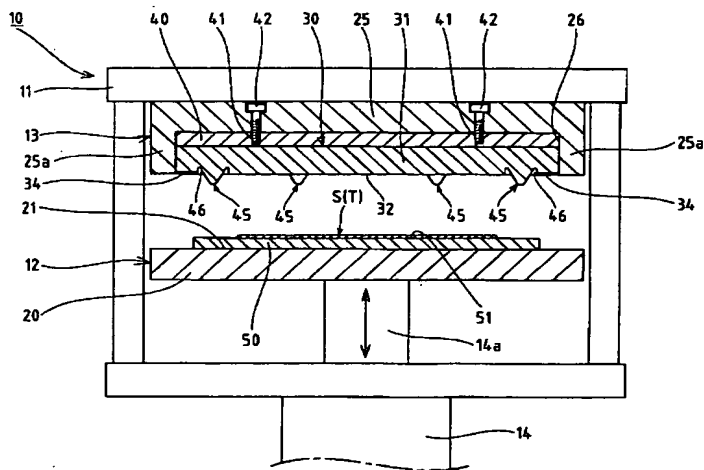
【図4】



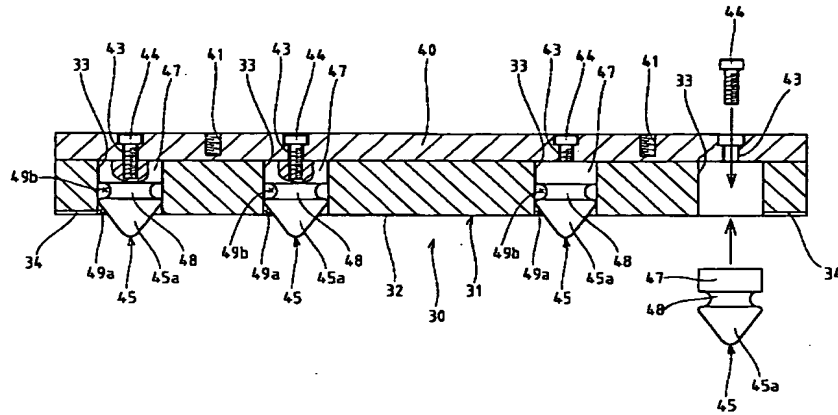
【図7】



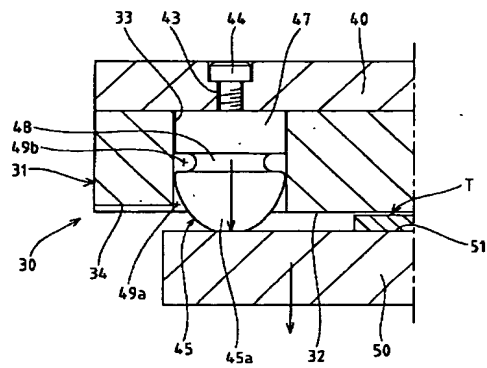
【図5】



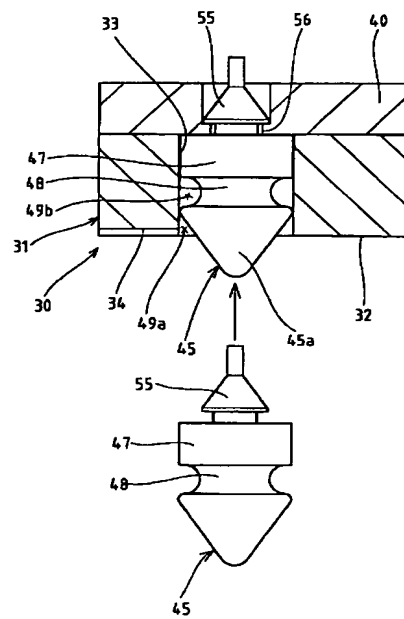
【図6】



【図8】



【図9】



フロントページの続き

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5E082 AB03 BC40 MM12 MM22